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# *Executive Summary*

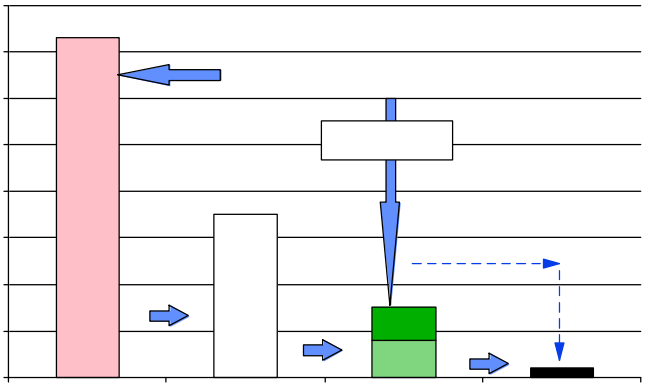
NASA is adjusting to a new environment where technical excellence is not the only goal. The President, the Congress, the NASA Administrator, and most of all, the American people, have made the new challenge to NASA clear: work smarter, use resources more wisely, and focus on problems of national significance. The old thinking will not suffice any longer. New ways of doing business, of solving problems, of meeting the national needs must be found to make the agency work better, faster and cheaper. Today, commercial relevance is also a strong consideration in every R&D program. These changes must occur if we are to continue to make contributions to our nation which are as important as our contributions of the past.

NASA's primary missions remain aeronautical research and the exploration of space, however, it is clear that these missions can be accomplished with equal or greater success by leveraging the best of NASA, private industry and others through partnerships. These teaming arrangements offer economies of scale, cost reduction and faster results. In the information age, sharing knowledge is key. NASA is facilitating this communication through aggressive adoption of electronic information tools while at the same time, fostering an environment where all this information can be quickly acted upon with results.

NASA field centers have been given both the responsibility and authority to succeed. The field center commercial offices have been revitalized. The results of their efforts are being tracked and will be held up for the world to see. Using agency-wide teaming concepts, the field centers are trying new things and have stopped doing some things that no longer make sense. They are applying the energy needed to make this a success. They are aggressively reaching out to U.S. industry, universities, state and regional organizations and others to share our storehouse of knowledge and expertise, to leverage our facility investments, and to join together to solve mutual problems.

While we have only just begun to give this important issue the attention it deserves, results are already evident. There are more cooperative agreements in effect now than any time in the agency's history. Major new programs are emphasizing the importance of private sector investments to match NASA's. The value of our technologies is no longer taken for granted. We are treating our technologies as assets which must be handled carefully, thoughtfully and effectively. We are obtaining legal protection for our commercially valuable technologies and working closer with private industry to realize the benefits of these technologies for the American public.

# Introduction



The general public knows that NASA is responsible for launching humans and spacecraft into orbit. They know that we produce space science missions that provide us with volumes of information about our universe and countless images of the planets and stars. They are even aware that we are continually working to expand the boundaries of flight. What they don't know is how NASA technology improves our quality of life, creates new industries and high quality jobs, and supports the international competitiveness of our industrial base.

The 1994 report titled: *NASA Commercial Technology: Agenda for Change* is NASA's blueprint for expanding and improving these contributions to the nation. This *Progress Report* is the first of the annual progress reports called for in the *Agenda for Change* It is meant to serve as evaluation of our progress to date and an indicator of the direction we are moving.

This report provides a brief overview of our progress. Further information about any aspect of this report may be obtained from the Commercial Technology Offices at each of the field centers or from the Commercial Technology division of the Office of Space Access and Technology at NASA Headquarters. Reader comments and feedback are welcome.

## The Structure of Our Approach

In order to achieve the goals of the *Agenda for Change*, we developed a top-level process flow to define the functions and processes that NASA must focus on. This framework is based on the requirement that NASA technology maximize its contributions to the nation's economy. This requirement is underscored in the National Performance Review (NPR) which states that NASA should devote 10 to 20 percent of its budget to R&D partnerships with industry. This requirement necessitates a process to inventory the unique and commercially applicable assets of the agency, form research and development partnerships with industry around these assets, determine the overall level of NASA technology commercialization and determine the long-term economic impact to the nation of the partnerships.

In Figure 1 above, this framework is illustrated in terms of commercialization stages. Stage 0 represents NASA's annual budget. Stage 1 represents that subset of NASA's budget (Stage 0) which is determined to have commercial potential. The level of this stage will be determined by the inventory requirement of the marketing team. Stage 2 is the total value of NASA contribution to all partnerships with industry. Presumably all technologies involved in partnerships will have been identified in Stage 1 and selected by firms to meet a specific commercial need. When this stage equals 10 percent to 20 percent of NASA's budget the Agency will have achieved the NPR

goal. Stage 3 represents the portion of partnerships (Stage 2) where industry has successfully introduced NASA technology into the marketplace. As with Stage 2, this stage measures the direct value of NASA's contribution to this success.

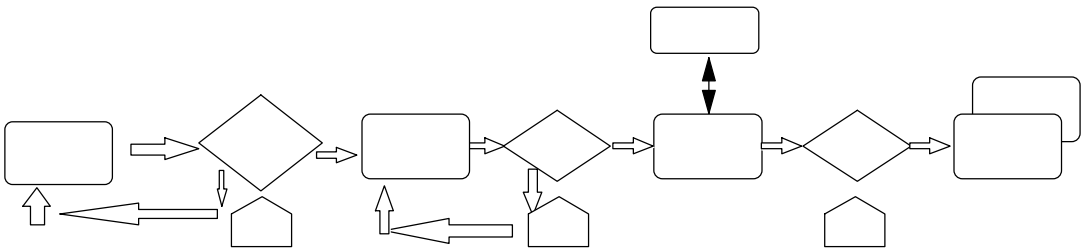


Figure 2 is a flow diagram that outlines the basic steps we are using to evaluate NASA's technology in order to determine where our efforts will yield the greatest results. A relational database is being developed to capture the data for this entire process. The first step is to inventory all of NASA's R&D. This will provide an overview of our entire potential "product line" and will be the responsibility of each NASA program office. The second step involves the identification of those technologies with the greatest commercial potential. Criteria for making this determination are now being developed. Cataloguing technologies with high commercial potential will enable us to conduct agency-wide targeted marketing for clusters of related NASA technologies. This catalogue will also serve as the database for our Commercial Technology Offices and external agents to search through in response to a company's request for technical assistance.

The third step is to measure the number of partnerships formed between NASA and companies to commercialize technology. The total number of these partnerships as well as the level of investments on both sides will be tracked. The fourth and final step in this model will be to evaluate the economic benefits to the nation derived from these activities. A process which provides a quantitative and qualitative measure of return on taxpayers investment is being developed. This step will be the most difficult and perhaps most contentious but also the most useful to our elected leaders and the public in determining the value of their investment in NASA's research and development.

## *Interrelated Plans*

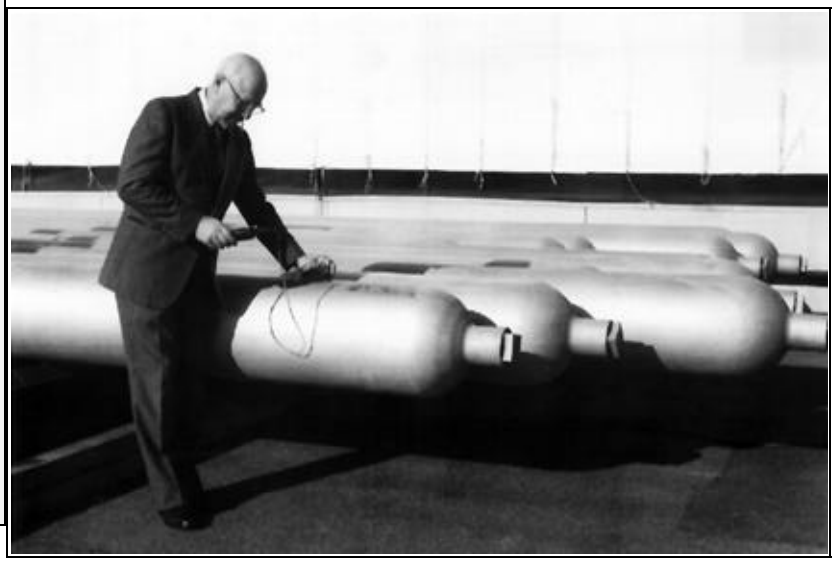
The success of our overall effort rests on several interrelated activities called for in the *Agenda for Change*. For example, the entire effort necessitates that NASA management support and embrace the new commercial policies now in the concurrence process. Relatedly, the acceptance and implementation of these policies relies heavily on the training and education of key agency personnel. Additionally, the collection of much of the data and communications between installations will rely on an electronic network which reliably serves as the backbone of the whole effort. And finally, the use of performance data relies on the development of sensible "metrics" which accurately demonstrate program effectiveness but do not skew actions for the sake of appearance.

In order to achieve maximum commercial benefit from NASA technologies--NASA needs to transition more technologies from Level 0 to Level 2 and Level 3 and reduce the time frame for doing this. At any point in time, NASA should have at least $1.4 to $1.6 billion at Level 2 or higher. By sorting the agency's technology assets with the decision process outlined in Figure 2 into the categories in Figure 1, we create a continuous process that will be updated on a quarterly basis.

An alternative coronary vascular treatment to heart bypass surgery has been developed by Advanced Interventional Systems (AIS), Inc. of Irvine, Calif., the recipient of JPL-developed and Caltech patented pulsed excimer laser technology.

The AIS **pulsed excimer laser coronary atherectomy system** has been applied successfully to coronary atherectomy and coronary arterial plaque removal procedures to treat blocked arteries of the heart. Cardiovascular disease is the leading cause of death in the U.S. The cost of this disease is placed at 17 billion dollars annually. With a success rate of more than 90 percent, patients undergoing the laser atherectomy treatment are able to return to work within just a few days rather than the six months usually required for heart bypass surgery. Additionally, laser atherectomy costs about one-third of what other techniques cost. The laser atherectomy system was approved by the FDA in 1992.

Krautkramer Branson (KB), a subsidiary of the Emerson Electric Company, made its first delivery of a KB Instruments **"Crack Finder"** (right) to a customer in January 1995, less than 6 months after licensing the enabling technology from NASA Langley Research Center and only 11 months after being selected as Langley's industry partner to commercialize that technology. The Crack Finder is a compact, handheld instrument and probe designed for rapid scanning of metal surfaces to detect surface-breaking cracks. The self-nulling, eddy-current technology on which the Crack Finder is based was developed by Langley for application to aircraft fuselage skins.



The Great Lakes Industrial Technology Center (GLITeC) in conjunction with the Lewis Research Center have formed the **Consortium on Advanced Coatings and Surface Modification**. The purpose of the consortium is to transfer advanced coatings and surface modification technologies develop at Lewis to the member companies. All the work will be conducted under a reimbursable Space Act Agreement which was signed between Lewis and GLITeC in August 1993. As of September 1994, six companies have joined the consortium.

# *Implementing Change*

or NASA to be successful in leveraging a greater portion of its research for commercial applications, it must establish a strong implementing policy to guide the efforts across the agency. Much has been accomplished in this regard since the introduction of the *Agenda for Change.* Since July 1994, copies of the *Agenda for Change* have been distributed to all employees at the NASA field centers and all program offices at headquarters. Additionally several thousand copies have been distributed to private sector companies and other organizations through conferences, trade shows and other means. We've broadcast its message both inside the agency and to customer groups on the outside. We've made it known that NASA is adopting new ways of doing business and that we are undergoing a transformation in the way we achieve our mission objectives.

In the coming months, NASA will release a more detailed implementation plan which will clearly identify agency commercial technology goals and objectives and appropriate means of achieving them. This document will provide clear and concise guidance to all components of NASA on how everyone can contribute to the agency's overall goal of conducting up to 20 percent of its R&D in partnerships with industry. While this document will be helpful to the commercial specialists, it will be especially useful to those sections of the agency which have heretofore been more removed from this focus.

Over the past several months, the commercial technology mission of NASA has been supported and reinforced in the agency's strategic planning process. Representatives of the NASA Commercial Technology Management Team have been integrally involved with development of the NASA strategic plan. Many field center directors have recognized the importance of the commercial technology mission and responded by strengthening their commercial technology offices. In many cases, additional staff have been allocated to the effort to facilitate the leveraging of NASA's knowledge base for private sector purposes. These people have been imbued with a new sense of the importance of this job. These changes represent a real commitment to NASA's commercial technology mission. These organizations have been aggressive advocates of the commercial technology message by informing and educating the various institutions at the field centers about the new ways of doing business.

# *Developing the Skills*

In order to realize the goals we seek, we must attain greater skills in certain categories. The fact is, in the past, NASA has not invested heavily in many of the business skills needed for this new arena. We must change this fact. To begin with, broad awareness throughout the agency of the commercial technology goals is mandatory. Wide distribution of *Agenda for Change* to scientists, engineers, contractors and others was the first step in this direction. The delivery of presentations, reports, testimony and other communications over the coming months and even years will be required to effect the kind of change that we have in mind. This proselytizing will always be necessary to combat a natural decline of enthusiasm.

In addition to this ad-hoc mission work, we have developed a two-tier plan to formally train ourselves in the subjects needed. First, a two-hour training module is being developed and will be available for presentation to all NASA employees. This "awareness course" will provide a topical understanding of NASA's commercial technology mission to all NASA employees. It will provide an understanding of the concepts of industry alliances, metrics, etc., which are not clearly understood by many NASA employees Following an initial presentation of the course at a center "test site," the rest of the field centers will offer the course by late spring..

A more detailed training module, approximately eight hours in duration, is being prepared for presentation to employees at the division director level and above. It will provide an understanding of recently enacted federal laws regarding technology transfer, dual-use technology efforts, suggested outreach programs, and patent licensing agreements, to mention a few. The eight hour module will be ready for review in early spring, with an initial test site delivery in the early summer. NASA-wide exposure should be completed by the fall.

One of the tools designed to facilitate communications between the various NASA institutions, the ***NASA Commercial Team Directory*** is now available. This document will be updated approximately each year and will evolve to meet the evolving needs of NASA's commercialization professionals. Copies may be obtained from the Office of Space Access and Technology at headquarters or from the Commercial Technology Office at each field center.

# Reaching Out

In reaching out to our customers, the NASA-wide marketing team has focused on three primary areas outlined in the *Agenda for Change*. We believe that these activities are a logical first step to clearly identifying what NASA has to offer and understanding the level of interest in these offerings on the part of industry. The activities are:

1) Conducting a center by center inventory of unique and commercially applicable assets;
2) General marketing to inform the public of commercial technology opportunities, and;
3) Targeted marketing to a pilot set of non-aerospace industry segments.

## *Inventory of Assets*

Over the July-December 1994 time frame, the marketing team conducted a high-level inventory at each of the 10 field centers. This effort resulted in the identification of 78 different high commercial potential technologies. These technologies cover 11 broad technical categories: materials, manufacturing, environment, energy, software, computers, communications, medical, sensors, instrumentation, and transportation. Using a common format, the team then produced marketing materials which highlight the potential commercial uses as well as the concrete benefits of each technology. These materials represent the first of many sets of clearly laid out "product" sheets which will enable a variety of marketing activities.

In addition to the technology inventories, several field centers began to inventory their facilities and technical expertise. Goddard, Johnson, Langley, Marshall and Stennis have each conducted an inventory of their facilities and have the information available in written form for public distribution. Ames is updating a facility assessment which was prepared in 1993 and rates facilities with a relative commercial value factor. Kennedy is currently conducting a survey to define its technical expertise and facilities data. Finally, Johnson, JPL, Kennedy and Marshall have compiled data on all patents available for commercialization at their sites.

## *General Marketing*

Approximately 1.5 million people in the U.S. suffer the effects of low vision caused by age-induced macular degeneration, diabetic retinopathy, glaucoma, cataracts, and strokes. A new device called the **Low Vision Enhancement System**, (LVES) has been developed at the Johns Hopkins University Medical Center in conjunction with the Department of Veterans Affairs and NASA Stennis Space Center. Utilizing modified image processing algorithms originally developed for remote sensing applications, the LVES is a headset worn over the eyes like goggles. Three small video cameras capture external images and project them on screens located within the headset. Two of the cameras provide a three-dimensional, unmagnified wide angle view with a third providing magnification capabilities. Currently the LVES is marketed by the Visionics Corporation which has an exclusive license to develop, manufacture, and market this product. Visionics currently employs 25 people at its Minneapolis facility with 10 additional personnel located in South Carolina and at the Johns Hopkins University.

In November 1994, field centers rolled out an aggressive marketing effort at Technology 2004 in the Washington D.C. Convention Center. The central purpose of this event is to showcase technological advances by the federal laboratories which have strong commercial potential. For the first time, the NASA field centers organized their displays by the 11 industry categories listed above rather than by field center. The strategy was to focus on customer needs rather than agency organizational structure. The field centers worked together to market each other's technology. This strategy was very well received by attendees and provided a great learning experience for the agency.

As a means of cultivating new partnerships with industry, the Langley Research Center held a **Technology Opportunities Showcase (TOPS)** in October 1993 and again in April 1995. TOPS is Langley's approach to NASA's new thinking about how we communicate and work with U.S. industry for the betterment of the nation's competitiveness. This "open house" of new technology exhibits was attended by over 800 and 900 industry representatives in '93 and '95, respectively. These attendees represented well over 400 companies. Both TOPS events resulted in thousands of requests for additional information. In '93, 30 of these requests resulted in NASA-Industry cooperative activities to further develop the technologies, 6 technology patents have been licensesed to industry and several more licenses are pending. Thus far, the '95 event identified 79 individuals or companies who want to license Langley technology.

**Space Act Agreements** with private sector organizations in final review which focus on dual development and commercialization of various Johnson technologies. Johnson has been actively working with the Montana Indian Manufacturers Network and the State of Montana to identify specific technologies to commercialize. In addition, Johnson is has signed an MOU with the State of Louisiana to identify technologies that are of particular benefit to Louisiana. Johnson opened the center twice in '94 to small and small disadvantaged businesses to showcase Johnson technologies and facilities and explore cooperative activities.

Technology 2005, scheduled for October 24-26th in Chicago, will be the first of the series to be held in the midwest. NASA is planning an aggressive marketing campaign to ensure local and national industry awareness of the event and the opportunities it avails. Based on lessons learned from previous events, the NASA exhibit will be designed to facilitate contact with industry participants. NASA's primary goal in doing so is to see that U.S. companies can quickly and easily take advantage of the agency's inventory of technology.

Also, due to evolving needs and increasingly tight resources, NASA's continued support of the "Technology 200x" series is under review and will largely be determined based on the success of Technology 2005.

Each of the NASA field centers has identified a number of approaches for linking up with potential private sector partners. For example, Langley is planning a repeat of its successful Technology Opportunity Showcase event (see sidebar page 8) and Johnson is preparing its Technology Commercialization '95 Workshop in April and participation in biotechnology conferences in both Houston and San Francisco. A general list of these tools include:

1) Attending targeted industry trade shows;
2) Holding technology opportunities showcases on-site at the field centers;
3) Conducting direct mail campaigns;
4) Publishing newsletters which highlight technology opportunities;
5) Marketing NASA's technology and capabilities at local, regional and national meetings with business groups;

6) Use of Internet to market agency technology and facility capabilities and opportunities.

The NASA marketing team is in the process of developing metrics to analyze which events yield the most return and will report on this in the next progress report.

# Partnership with Industry

The *Agenda for Change* defined seven business practices: Contractor-Developed Technology Commercialization, Industry-Led Technology Development Partnerships, Dual-Use Technology Development, Commercial Technology Acquisition, Small Business Technology Development and Commercialization, Regional Alliances, and Post Technology Diffusion. These classifications provid a structure of NASA's relationships with industry and help us understand which mechanisms work best in which situations.

All of NASA's commercial technology transactions, from simple assistance agreements to standard licensing agreements, including complex dual-use partnerships, achieve the goals of at least one of the practices. This taxonomy enables us to classify our commercial technology activities based upon what we achieve rather than the type of legal transaction.

Since over 85 percent of NASA's R&D budget is spent through contracts, the vast majority of technology developed by NASA is in fact developed by companies for the agency. This fact necessitates a focus on these programs and projects if we are to have any chance of reaching the NPR requirement that 10 to 20 percent of NASA's R&D budget be conducted in partnership with industry. The new technology reporting requirement, which is part of all contracts, is key to catalyzing commercialization of NASA-sponsored, contractor-developed technology. We are currently reviewing the guidelines and procedures related to this requirement.

Additionally, we have taken a fresh look at how we use our network of technology transfer organizations. To make better use of the experience and local industry knowledge resident within the Regional Technology Transfer Centers, they are now managed by the field center(s) in their region. This will improve communications and focus everyone on regional issues.

Marshall, Kennedy, Stennis and the southeast Regional Technology Transfer Center (RTTC) have agreed to jointly work to reach out to industry within the southeast United States. The partners are meeting regularly to coordinate industry assistance efforts, and to standardize metrics and reporting for the southeast region.

In support of the **Southeast Regional Outreach Partnership**, Kennedy has intensified its ongoing outreach activities with the Florida Technological Research and Development Authority (TRDA). Kennedy and TRDA have agreed to jointly fund an outreach effort managed by TRDA and effected through Florida's 67 Economic Development Councils. The Councils regularly reach 240,000 manufacturing sites within Florida and will meet face to face with at least 10 percent of these sites each year in support of Kennedy and the regional partnership. The agreement is expected to generate a significant increase in awareness of NASA's outreach program within Florida.

A team involving the **Florida Technological Research and Development Authority** and the Sarasota-based Loral Test and Information Systems formed a partnership with the Kennedy Space Center in 1993 to promote the development and manufacture of the Universal Signal Conditioning Amplifier (USCA). This state-of-the-art signal conditioning amplifier can universally connect all types of sensors and transducers to current and proposed data acquisition systems. It will replace thousands of analog amplifiers at Kennedy and dramatically reduce manpower requirements for manual preparation, data collection and maintenance. In addition, the USCA units have a broad range of commercial applications and are being marketed by Loral to private industry. The first units are expected from the Loral production lines in early 1995.

## *Pilot Partnerships*

Over the past 12 months, we have initiated two pilot marketing initiatives aimed at the health care information systems and manufacturing industry sectors. Through a consortium known as the Health Care Open Systems and Trials (HOST), we are working to create, test, integrate and demonstrate essential information-related technologies needed at all levels of the national health care system. Through the year 2000, the market for these technologies is projected to reach $45 billion in sales. HOST is a consortium of health care providers, insurance companies, and information technology providers with a combined 10 billion dollars in sales. We are currently identifying potential dual-use projects.

We are also working with the National Center for Manufacturing Sciences (NCMS), a consortium whose aim is to develop and implement next-generation manufacturing technologies, processes, and management practices. NASA and NCMS are currently discussing dual-use collaborations in: next generation abrasive water-jet machining; plastics and composites joining using intrinsically conductive polymers; adaptive plasma arc welding; machining of ferrous materials; flat panel display manufacturing; manufacturing autonomous agents; manufacturing ergonomics. Marshall is coordinating the overall effort while the specific field centers have technical coordinating responsibility.

Also in development is an agency-wide marketing plan which will identify high potential industries to focus on over the coming year. The plan will also outline the most appropriate approach(es) for each sector. It is scheduled to be completed by May of 1995. In addition to these activities, most of the field centers are working their own targeted activities with other consortia and local/regional/state alliances. These activities build on each field center's more intimate knowledge of its region and how best to approach various local organizations.

**An air traffic control breakthrough** proven in September '94 in joint NASA/United Airlines tests, allows airline traffic to be routed within 20 seconds or less of a scheduled time, and at the same time, enables fuel-efficient descents initiated at the pilot's discretion. The Descent Advisor is a software tool that provides controllers with the benefits of a flight management system by continually computing an optimal descent trajectory, including a top-of descent point and speed profile. The Descent Advisor has proven to lead to better sequencing and scheduling of arrivals during busy periods and provides more direct routing and optimized descents leading to potential savings to airlines of 100-300 lb. of fuel per arrival. This project was a joint research project of Ames Research Center, the FAA and United Airlines.

# *Electronic Commerce*

The implementation of the *Agenda for Change* initiated electronic networking and data management activities across NASA. In the current phase, these activities are focused on creating a robust electronic network to support and enable NASA's commercial technology mission and emerging commercial technology network by 1996. Accomplishments thus far include the creation of NASA's Commercial Technology "Homepage" on the World Wide Web and the demonstration of prototype Internet/networking capabilities involving all field centers. In addition, the installation of a common management information system (TechTracS) across NASA to support technology commercialization will be fully implemented by late spring 1995. Most of the field centers already have some information on available technologies, research and test facilities, and technical expertise on the Internet. Building upon these and other emerging capabilities, the electronic network will evolve to serve as:

- A *national resource* for the U.S. private sector, providing electronic access to information on available NASA technologies, research and test facilities, and technical expertise;
- An *electronic market place* for technology commercialization, facilitating communications and partnerships between NASA and U.S. private and public sector organizations;
- A *paperless* communication and information tool for the management, integration and operation of the NASA Commercial Technology Network as a national *virtual organization*; and,
- An integrated means of electronically linking with complementary private and public sector networks, services and resources throughout the nation and the world.

The electronic network will be significantly upgraded and tested in 1995 to support these key operational roles and related requirements stemming from the *Agenda for Change*. The customer-driven design and implementation of the network will seek to

Since bringing our **World Wide Web "Homepage"** on-line in early 1994, literally thousands of people have used it as a convenient source of information about NASA technology and the means to use it. Between November '94 and March '95, there were 95, 237 "hits" to access information on our Web site. As we increase the variety and depth of information at our site, this dissemination/education tool will become even more useful.

The Cedars-Sinai Task Team at Dryden Flight Research Center was established after Dr. Phillips, Director of Endoscopic Surgery at Cedars-Sinai Medical Center in Los Angeles, Calif., and Dr. Raul Rosenthal visited the Dryden Center. That visit led to the development of a new surgical instrument which improves safety and reduces the time it takes surgeons to close the small abdominal wall incisions after endoscopic surgery.

The tool was created using aircraft machinery tools in Dryden's machine shop. Dr. Edward Phillips supplied two members of Dryden's Task Team, Adolfo Morales and Greg Poteat, with a sketch of what he required for the instrument. Morales turned the sketch into a detailed drawing and Poteat created the instrument. As of this writing, the tool has been used successfully in surgery several times at Cedars-Sinai.

The task team will continue working with the doctors on additional biomedical applications and are already working on a new device expected to improve the quality of life for at least 100,000 people.

integrate core and decentralized information resources, networking capabilities and client services within a comprehensive, innovative architecture based on the Internet and other supporting information systems. Focusing first on NASA's internal technology commercialization operations and activities, the electronic network will be expanded to fully encompass and leverage the National Technology Transfer Center, the NASA Regional Technology Transfer Centers, and other external technology commercialization operations sponsored by NASA. In addition, partnerships with federal/state agencies and other private/public sector organizations will be developed to coordinate efforts and strengthen the electronic network.

It is anticipated that the electronic network will provide a catalyst and means for the further re-engineering of NASA's technology transfer and commercialization operations to achieve higher efficiencies and a greater economic return on NASA R&D. In doing so, a key challenge for 1995 will be to maintain a strong customer focus to guide and continually improve electronic network capabilities, services and information resources essential to NASA's *new way of doing business* in the acquisition, transfer and commercialization of technology.

NASA's **Jet Propulsion Laboratory is revolutionizing imager technology** with the Active Pixel Sensor (APS). The design is based on the idea of combining all the components necessary for image sensing on a single computer chip. APS uses 100 times less power and can be packaged in 10 times less volume. These features make it very attractive with respect to the current focus on small, low cost, low power spacecraft and instrumentation. It is thought that the APS could replace the CCD in many applications. Because the CCD requires a special foundry for fabrication and a half dozen other electronic chips to integrate component it is expensive, more bulky and requires a significant amount of power. Also, the APS manufacturing process will provide a competitive edge for U.S. companies competing in the large imager marketplace which is currently dominated by foreign firms. APS technology is expected to hit the market in less than 12 months. JPL already has agreements with AT&T for video-conferencing and Kodak for electronic photography.

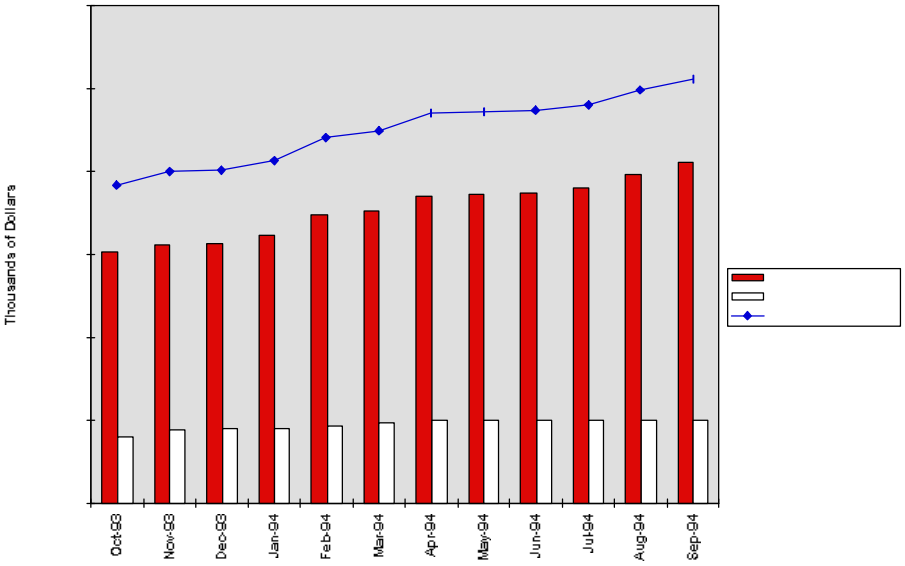
In September, 1994, Goddard Space Flight Center co-sponsored the **Northeast Regional Commercialization Workshop** focusing primarily on manufacturing applications of lasers and photonics. The event led to Goddard negotiating capaciflector partnering activities with several companies for various applications including: museum and prison security, automotive sensors, and "smart valves", which monitor their own wear.

# *Measuring Our Progress*

NASA commercial technology metrics activities are structured around the concept that the agency will publish a quarterly statistical and anecdotal report of NASA's commercial technology accomplishments. Each quarterly report will present progressively more insightful and more encompassing metrics information.

With the publication of this Annual Progress Report (which also constitutes the report for the fourth quarter of fiscal year 1994), NASA has completed three iterations of its metrics reporting cycle. In the future, metric reports will be issued approximately 30 days after the close of each fiscal quarter. These metrics are designed to measure the degree to which NASA is achieving its partnership goals. It should be noted that the most valuable metric contributions to this report are not the narrative but the various statistical assessments and anecdotal illustrations of NASA commercial technology achievements that appear throughout the report.

This year's metrics work has established an overall direction for metric collection, analysis and reporting. Decisions as to which metrics are to be collected have been based on two primary sources.




The first of these sources is the clear interests of key stakeholders,

The **Technology Transfer Outreach Program** at the Marshall Space Flight Center in Huntsville, Ala., was initiated in 1989 to establish formal means of placing technologies derived by NASA and its contractors into the hands of American businesses, academic institutions, and individuals. Teams of technology transfer experts visit industries, schools and individuals throughout the southeastern U.S., examining first-hand problem areas and often making on-the-spot recommendations for solution. The Marshall outreach program has Memoranda of Understanding with seven state governments and is working closely with state organizations to more effectively accomplish its mission. In the first assessment of this effort from January 1993 to July 1994, an independent study has shown $358 million has been returned to the American taxpayer in the form of new jobs, jobs saved, more efficient use of resources, better global competitiveness and enhanced manufacturing techniques. The report estimates 5,300 jobs in 32 states were either created or saved by this program.

including Congress, the Administration, key NASA executives and the media. These interests focus on the economic impact of NASA's achievements. The other source is an analysis of NASA's commercial technology processes to reveal measurements that truly mark the progress and effectiveness of these processes. This second source suggests measures that will be of great importance to NASA management, field centers and other participants in NASA's commercial technology program as they determine where commercial technology investments are most valuable, which programs and practices are being implemented and with what results, and where effectiveness and efficiency may be improved.

NASA is very aware that estimates of the economic impact of NASA commercial technology activities are of great interest to key stakeholders. These estimates are often termed "Returns on Taxpayer Investments" or ROTI and are developed by economic modeling. Many of the measurements that already have been collected and reported will be important parametric inputs to ROTI economic models. These measurements, then, constitute a good start at ROTI estimation. In addition to gathering these measurements, NASA has conducted and published a survey of NASA "customer" satisfaction, which provided valuable interim insights into and a baseline for NASA's commercial technology mission. Further, Marshall has completed its first 6-month assessment of the recipients of its technical assistance activities and published its results (see side bar on page 14). This analysis, based on economic impact data provided by industry partners, provided the initial measurement of NASA's impact. Evaluation of these fiscal year '94 products by economic advisors will be an important activity during fiscal year '95.

**The following are the key metrics which we plan to institute throughout the agency to measure its commercial performance.**

**Commercial Activity Level**

This metric shows the activity levels for each type of commercial practice. For each month it shows the new, ongoing, closed and net activity totals. This data is collected in the quarterly data collections.

**Commercial Investment Level**

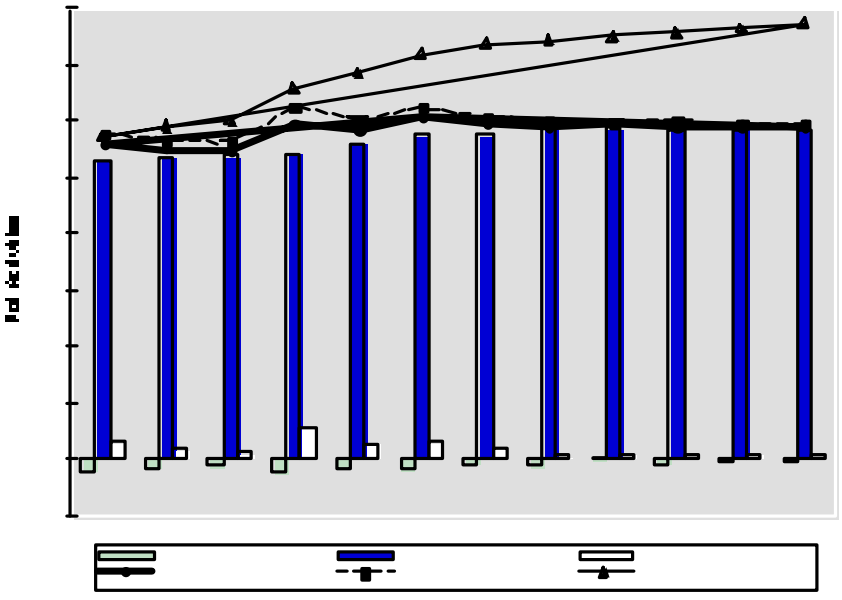
For each commercial practice type, this metric shows the estimated annual spending on the collaborations shown in the Commercial Activity Level metric defined above. Each month's data point shows how the estimated annual spending will change as a result of that month's activity i.e. those activities which have closed and those which have started.

**Partner/NASA Contribution Ratio**

For each commercial practice type this metric shows a monthly update of what portion of the Commercial Investment Level from above is contributed by NASA and what portion is contributed by the partner. The general goal at this time is a 50/50 ratio.

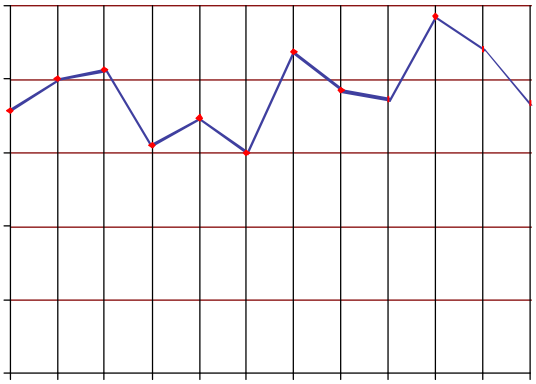
**Commercial Potential Index**

For each commercial practice type, this metric estimates on a monthly basis what portion of the Commercial Activity and Commercial Investment Levels have commercial potential. Specifically this metric will show that portion having high potential, medium potential and low potential.



The primary measurement tracked by the agency in fiscal year 1994 has been the scope and value of commercial technology agreements in place between NASA and its industry partners. This is a measure of NASA's investment in commercial technology and also directly measures progress toward the Administration goal that 10 to 20 percent of NASA's R&D be conducted in partnership with industry.

At this point the agency has gathered a substantial database of information on its agreements, which allows analysis of NASA's commercial technology activity from a number of perspectives, such as by geographical distribution, by field center, by technology, or by commercial technology practice.



At this time the basic elements of a metrics program are in place, and fiscal year '95 should yield not only substantial metrics reporting but also important insights into both NASA's commercial technology activities and how to improve them.

# *Conclusions for the Future*

NASA has made solid progress in responding to the needs of our nation to better leverage our R&D to U.S. economic security. With the *Agenda for Change*, we laid out our strategic plan and are now in the midst of its implementation. We are inducing the NASA culture to give greater consideration to the commercialization of our discoveries. The reinvigorated Commercial Technology Offices at each the field centers have embraced this challenge and are working to communicate its rationale, importance and processes throughout the agency. We have defined ways to better identify technology and more expedient ways to transfer it.

The program offices at headquarters have been involved with this evolutionary process and are introducing our commercial goals to the program and project managers in their organizations. We recognize that achieving the buy-in of these managers is critical to our ultimate success since it will be they who will review the commercial plans of proposals, evaluate progress in those plans and make contractor award-fee decisions based on final analysis of the effort.

While some changes will likely be necessary along the way, the development of a meaningful set of metrics has provided a basis to make sound decisions on the effectiveness of our programs. Used appropriately over time, these metrics will enable the nation to get the most from our collective efforts to commercialize NASA technology. Developing a reliable model for economic impact of technology is our next challenge, but one that will provide us with a valuable tool for demonstrating the importance of NASA technology to the nation's economic well being.

The use of electronic means to collect the metrics data has positioned us well to broadly apply these tools. In this regard, we are leading the federal government in the creation of and use of electronic tools to communicate, manage and conduct normal business practices. Aggressive use of these systems has been a catalyst for innovative thinking and has seeded our philosophy with ideas that will yield fruit from the work we do in the future.

NASA upper management has been supportive of this effort and will need to remain so for the foreseeable future. Effecting the magnitude of change needed will require continuous pressure from the highest levels of the agency to make it clear that this is not a fad. We have made significant progress in opening NASA employees to this new focus and must now continue to enrich their understanding of and appreciation for it to ensure success.

Finally, everyone must recognize that this will not be painless process. It will not be accomplished without making some tough and unpopular decisions. It will not occur without the prior acceptance that some of our efforts may not be fully successful. Also, as the nation's expectations of us evolve, we will have to rethink our approach and occaisionally change focus. We must be willing to do what is necessary to succeed. If we are, we will.

# *NASA Commercial Management Team*

This report reflects the input and accomplishments of the NASA Commercial Technology Management Team whose members are listed below. Questions and comments should be directed to Robert Norwood, Director Commercial Technology, Office of Space Access and Technology, NASA Headquarters or any other member of the team.

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